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THE TELEGRAPHIC JOURNAL

AND

ELECTRICAL REVIEW.

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VOL. IV. NOVEMBER 1, 1876. No. XC.

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THE TELEGRAPHIC JOURNAL.
VOL. IV.—No. 90.

NEW ZEALAND TELEGRAPHY.

THE Government of this enterprising colony has just issued its twelfth Report. It is an exceedingly interesting and well-compiled document. It not only narrates the history of the telegraphic progress of the islands for the past year, but it furnishes very complete plans of the telegraph system connecting together the three islands which are called New Zealand. It appears that the revenue for the year 1875-76, which was estimated at £62,000, has exceeded that amount by more than £1,300.

The number of telegrams transmitted during the year was 1,051,086, being an increase over the previous year of 133,958. Including the value of General Government telegrams, the gross earnings of the department for the year amounted to £79,537 7s. 11d. The expenditure exceeded the receipts by £2,803 1s.: the expenditure incurred in the repairs of the Cook Strait Cable amounting to £3,363 15s. 5d., having been debited against the vote of the department, has placed the balance on the wrong side. Owing to the increased number of stations and the additional lines, the expenditure is greater than in any previous year. Several amounts have also been charged against the vote of the department, which, it is said, might with justice have been charged upon construction, and taken out of the telegraph portion of the loan.

The number of telegrams transmitted during the year, as compared with the number of letters posted during the same period, shows that 22·21 telegrams were sent for every 100 letters posted. This proportion is rather less than last year, when the comparative number was 22·59. It must, however, be remembered that there is an increase in the number of letters of almost 700,000, so that the proportion of telegrams is very satisfactory.

Since the date of the last Report, direct communication has been established with Australia. The cable was opened for business on the 21st February last, and has been largely used. The Wakapuaka Station has, since the date mentioned, forwarded to New Zealand stations, 3,467 telegrams. Of this number, 3,395 messages were received through the cable, from Sydney and places beyond, the average of words per message being 19·3. The number forwarded from New Zealand through the cable, to Sydney and places beyond, during the same period, was 3,268, the average of words per message being, in this case also, 19·3.

The number of Money Order telegrams sent during the year was 10,712, representing a value of £48,988 17s. 3d., or an increase of 1,062 messages, and of £2,498 17s. 5d., as compared with the previous year. The commission collected by the Post Office was £1,352 1s. 4d.; and after deducting £535 12s., due to the Telegraph Department as fees on the telegrams, there remained to the credit of the Post Office, as commission on exchange, £816 9s. 4d., almost £1⅔ per cent. on the amount transmitted. The largest number of orders was issued in Wellington, Dunedin coming next, and Christchurch next.

During the year, 118 miles of line carrying double wire, and 50 miles carrying single wire, have been erected; and 335 miles of wire have been added to the original lines, making a total addition of 621 miles of wire.

There are now opened to the public throughout the colony 142 stations, 15 of which have been opened during the past year, 9 in the South Island, and 6 in the North Island.

The length of line maintained during the year was 2,980 miles, the average cost for maintenance being £5 18s. 10d. per mile. This is exclusive of the amount expended in the repair of the Cook Strait Cable, which is referred to above.

At the close of the year, 3,154 miles of line, carrying 7,247 miles of wire, were in circuit, showing an increased mileage upon the previous year, in line 168 and wire 621.

The nominal strength of the department, including Linemen and Inspectors, on the 30th June, 1876, was 567, against 509 of the previous year.

The duplex system of telegraphy has been further introduced on the circuits between Blenheim and Christchurch, and between Wellington and Napier. It has been in daily operation upon the circuits mentioned for some months past, and on the cable since the 18th June, 1874, and has proved the greatest success. With all these facilities, the wire accommodation is not more than the increasing work of the department requires. It must, therefore, be obvious that the perfecting and introducing of the system has proved a very great advantage and saving to the department.

The sea has been found a great enemy to overground wires. Wherever it has been practicable the wires have been carried inland to avoid the influences of the salt spray upon the insulators. When the precipitous nature of the country would not admit of such deviation, every precaution has been taken to make the lines as perfect as possible by placing on separate poles the wires in the immediate vicinity of the sea. The poles are principally of the native timber, *totara*. Some notion of the work involving in erecting colonial lines may be gathered from the fact that between Hawera and New Plymouth the bush through which the line passed had to be felled two chains wide for the greater part of the distance.

Siemens' compound wire has been introduced throughout the city of Christchurch, and on account of the number of wires on the poles within the town its light manufacture has proved of great value.

English telegraphists will be surprised to learn that Varley's brown stone-ware insulators are being replaced by the Prussian white porcelain insulators in New Zealand, and not only is the insulation said to be considerably improved thereby, but that over some sections it has been made quite perfect. Varley's insulator has been condemned nearly everywhere but in England, where it still holds its own as the insulator *par excellence*. One man's meat is another man's poison, but can an insulator be good in one country and bad in another? Let the old country look to its laurels. The insulation of its wires is probably now the worst in the world.

ZINC AS A REMEDY AGAINST BOILER INCRUSTATION.

The employment of zinc as a means of preventing incrustation of boilers is of quite recent date (the first mention of it seems to have appeared in 1869, but it was not till last year that any considerable experiments were made on it); it is not surprising, therefore, that the opinions regarding its action are still very various. According to an experiment recently described by M. Klug in the *Zeitschrift für Paraffin, &c., Industrie*, the quality of the water is of no influence whatever in the use of zinc, and he considers that the only remaining difficulty is that of finding the right mode of use, in order to our possessing the surest and cheapest remedy against incrustation. He employed, in his experiment, a double boiler, and in both the upper and the under boiler were placed, at equal intervals, three bars of cast-zinc. These lay freely against the sides of the boiler by their ends (which were cut accordingly); in their middle they were about 200 mm. from the bottom of the boiler, and their position was at right angles to the axis of length of the boiler. These bars had a square cross-section of about 35mm., and all six together weighed 44·5 kil. Above the bars were strips of sheet-zinc, weighing together about 2 kil., fixed between the ends of the zinc bars and the boiler-sides. The boiler was fired on the 20th April of this year, and on the 11th June it was blown off, having thus been seven weeks in action. Its state was as follows.

There was no trace of incrustation, whereas the water, without employment of zinc, usually gave, in the same time, a layer of 2 to 4mm. In the lower boiler there was a very abundant deposit of slime; in the upper boiler a less deposit. The zinc bars in the lower boiler were entirely gone, and of the sheets there were only a few corroded fragments at the sides, these having been saved from further destruction by a firmly adherent crust of slime.

In the upper boiler, similarly, there remained of the sheets only a few fragments in the slime. The zinc bars, on the other hand, had been little altered in position; they only no longer lay freely against the boiler-sides with their ends, but were sunk down and fitted to the form of the boiler. Further, they had quite parted with their metallic character, and were transformed into a mineral mass somewhat like very loose clay. The volume was considerably increased, so that the square cross-section had about 55mm. length of side; the whole mass was brittle throughout, and easily pulverised. This explains the disappearance of the bars in the lower boiler. After the zinc bars were corroded as much as these, they broke up into slime.

To obtain a fuller knowledge of the nature of this remarkable phenomenon, it seemed desirable to make an accurate analysis of the substance into which the zinc was transformed, as also of the feed water, and the slime. The zinc residuum yielded the following result:—

1.	Moisture	0·55 per cent.
2.	Organic substances and carbon.	0·22 ,,
3.	Slime and silicic acid	0·67 ,,
4.	Gypsum	4·37 ,,
5.	Ordinary salt	0·42 ,,
6.	Carbonate of lime	0·25 ,,
7.	Sulphur	0·02 ,,
8.	Lead	0·90 ,,
9.	Antimony	a trace.
10.	Tin	,,
11.	Iron	0·80 per cent.
12.	Metallic zinc	2·30 ,,
13.	Zinc oxide	88·70 ,,

The matters 1 to 6 were undoubtedly brought by the feed water, while the others from 7 to 13 are constituents of the raw zinc merely increased by oxygen.

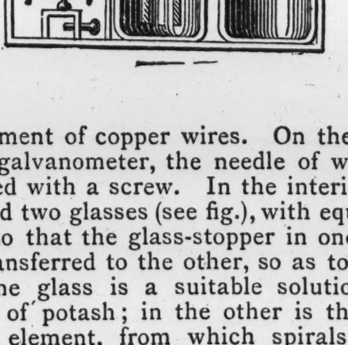
Neglecting the less important matters, the product of transformation of the zinc is found to be zinc oxide (without hydrate water). There can be no doubt, then, the author proceeds, as to how the phenomenon is to be explained.

The iron of the boiler shell forms with the zinc bars a galvanic element by which the feed water is decomposed. On the boiler surface that is in contact with water, hydrogen is separated throughout the process, while the oxygen is given off at the zinc, oxidising it. The continuous separation of gas bubbles on the boiler-sides prevents the adherence of the deposit; this can only be separated as slime. The composition of the water is accordingly a matter of indifference in this connection. The decomposition of the water, and therewith the prevention of incrustation, will take place with any composition of water. The influence which the impurities of the feed water may exert on its efficiency may be considered insignificant. The iron cannot in this process be attacked; on the contrary, we find a reduction of the hydrated iron oxide present. Whether the continuous electric tension may have an influence on the structural conditions of the sheet-iron, there is no evidence yet to determine. A remarkable point is the almost complete consumption of the zinc—viz., to 2·30 per cent. One would have thought that the action of the zinc bar would have ceased sooner. That with the use of zinc sheets, or even zinc blocks, which are on the bottom, but are protected from direct contact with the metallic iron by coatings of slime or incrustation, only imperfect results are obtained, is explicable from what has been said.

The consumption of zinc is in the case described pretty considerable. Further experiments should be made in order to find to what minimum limit one may descend in the employment of zinc.

A GALVANOMETER FOR TESTING LIGHTNING-CONDUCTORS.

The preliminaries necessary to testing lightning-conductors are often troublesome, the apparatus required for it being rarely obtainable in handy and convenient form, though, indeed, little apparatus is required; merely a galvanic element, a galvanometer, and a sufficient quantity of insulated copper wire. The firm of Mittelstrass Gebrüder, in Magdeburg, have recently combined the essential parts in a galvanometer chest the arrangement of which (described in a recent number of *Dingler's Polytechnisches Journal*) is as follows:—In front the lid is fastened with two hooks. At the side are two binding screws for attachment of copper wires. On the top is a sensitive galvanometer, the needle of which can be arrested with a screw. In the interior of the chest stand two glasses (see fig.), with equal width of neck, so that the glass-stopper in one may be readily transferred to the other, so as to close it. In the one glass is a suitable solution of bichromate of potash; in the other is the carbon and zinc element, from which spirals of wire proceed to the binding-screws as indicated. It is easy to lift the element out of the empty glass into the one filled with liquid, and so produce a current. In the third division of the chest is a roller with silk-covered copper-wire, which can be easily wound off, and, with the aid of a small handle, wound on again. Lastly, a binding screw serves for connecting the line to the wire-rope of the lightning-conductor.



Where desirable, the arrangement is so completed that only one turn of the conducting wire round the galvanometer needle is inserted, or all the turns; which can be done in a moment by turning a binding eye on the upper side of the chest. Lastly, on the under side of the lid may be introduced two resistance-coils of 1 to 10 Siemens' units, which, again, may be similarly inserted or excluded.

In testing a lightning-conductor the process is as follows:—1. The wire is unwound from the roller, drawn up to the roof, and the end of it wound about the point of the conductor. 2. The chest is opened, the element lifted over into the salt solution, the chest closed again, and so placed that the needle is still; then the binding-screw of the roller is connected with that of the chest with a piece of wire. 3. By means of the small binding-screw in the bottom of the chest a wire is connected with the lower part of the wire-rope of the lightning-conductor, and is brought to the second binding-screw of the chest. If there be perfect electric connection between the upper point of the conductor and the lower parts, the needle will be deflected. Should the deflection not occur, the place of interruption is sought for by connecting the lower binding-screw with the wire at successively higher points. 4. For investigation of the earth-conduction, the point of the lightning-conductor is excluded, by detaching the wire and connecting it with a neighbouring gas-chandelier, an iron spring, or an iron rod forced deep into the ground, and then the circuit is completed as before. The deflection of the needle will be greater, the more perfect the earth-conductor. Important advantage is here derived from the above-mentioned arrangements for insertion of the resistance coils, or only one or the whole of the galvanometer windings. After use, the element is lifted back out of the solution into the empty glass, and the galvanometer needle again arrested.

STONES AS CONDUCTORS.

BY M. TH. DU MONCEL.

(Concluded from page 270.)

As for the currents produced by the polarities developed on the stone, they may be referred in theory to an electro-static polarisation of the dielectric; for the gases arising from the passage of the current through the moist conductor, and produced in the stone itself, should be entirely condensed upon the electrodes. If, however, it is considered that the stone conductors are, as already explained, far from being homogeneous, and that certain portions of them may have a kind of metallic conductivity which places them in a position different from that of those parts which possess, more particularly, the electrolytic conductivity, it may be inferred that the first-named parts may act toward the others after the manner of electrodes, and themselves condense a portion of the gases resulting from the decomposition of the water. They ought, consequently, to produce effects analogous to those of platinum electrodes, and their action should be all the more distinctly marked, as they possess a greater conductivity; this increase of action should, besides, be produced at the expense of that of the electrodes. This is, in fact, what is shown by the experiment; so that we see that when a mineral presents a marked metallic conductivity, and is nevertheless capable of affording an electrolytic conductivity (as in the case of loadstone, oligist, zinc-blende, &c.), the polarisation current developed by the stone, with new electrodes, is very much more intense than that developed separately by the electrodes; the same current cannot even be discerned, when a non-electrified stone, of the same kind as that employed for the electrification, is used as an intermediate conductor; it is necessary, in order to show it, for a silex or a liquid to be interposed. On the other hand, we have seen, when experimenting with a body homogeneous in all its parts, such as the battery of slightly moistened leaves of paper which has been already described, that the leaves, separated from their electrodes, can give but very weak currents with new electrodes, even if they give any at all. All the energy of the polarisation is found, in the latter case, upon the electrodes, and this energy is sensibly diminished if strips of metal are introduced amongst the sheets of paper, for these strips absorb a part of the gases produced, and thus become themselves capable of giving out a current, when they are put into connection with a moist and non-electrified conductor.

By the preceding experiments it is demonstrated that non-metallic minerals become conductors by means of the moisture they contain, and their conductivity gives rise to very different effects, according as there is more or less moisture, or the stones are more or less porous. When the moisture is considerable, and the stones can, in consequence of their small amount of permeability, retain it, we have seen that the current passing through them increases in intensity the longer it flows; and this occurs even with liquids of high resistance, such as distilled water. When the moisture is, on the contrary, very slight, and the stones very porous, as in the case of calcareous stones, the intensity of the current diminishes very rapidly, and often at last falls to *nil;* this, no doubt, arises from the ready conversion of the liquid conductor into its gaseous elements, which are able to find their way easily out of the stone. In the last case, the diminution of the current cannot result from the effects of polarisation being more considerable; for the currents which these effects would produce would be much less considerable than those resulting from an increase of moisture in the stone. I believe, moreover, that there has been some misunderstanding as to the effects produced by the polarisation on the currents which pass through an electrolyte. If the electrolyte has a small resistance, the polarisation current, which is liable to arise, enfeebles the principal current in a greater or less degree, according to the energy of the electromotive force of the current; but if, on the contrary, the electrolyte has a high resistance, it is only after the lapse of a certain time that the current acquires the whole of its energy, by reason of the length of the variable period during which it developes itself, and which is then considerable; the electromotive force of the polarisation current is no longer sufficient to prevent the manifestation of the increase of electric intensity. This is the reason why the intensity of currents, passing through distilled water, goes on increasing, whilst it diminishes in the case of ordinary water, which has much less resistance. To return, however, to the subject of Stones.

If, after having electrified a mineral conductor during a certain time (say five minutes), we electrify it in the reverse direction for a few seconds (say twenty or twenty-five), the polarisation current shows itself at first in the direction corresponding to the last electrification; but it reverses itself at the end of a few moments, and takes a direction which would have been the result of the first electrification; it seems as if two opposite polarities had been imparted, one over the other. This phenomenon is, besides, common to all bodies which are inferior conductors, and which have an electrolytic conductivity; the duration of the electrification necessary to produce this reversal of current must be so much the greater, as the first electrification has lasted longer, and the electrolytic conductivity of the mineral is smaller.

If this phenomenon is closely analysed, new effects are discovered, which would, at first, scarcely have been suspected. The observation of the currents produced by the electrodes and the stone show, in fact, that *the electrodes alone are capable of producing the polarisation current corresponding to the second electrification, and the current corresponding to the first is always produced by the stone.* After an electrification of rather long duration, the latter current gradually developes itself during some time, and attains a maximum, after which it diminishes; whilst the first is rather quickly destroyed, and is never followed by a reverse current. It must not, however, be supposed that this superposition of contrary polarisations interferes with the development of the individual currents which result from them; for, by employing double electrodes, electrified in contrary directions, and placed one over the other, two currents, in opposite directions, may be obtained; these currents appear only when the electrodes are placed in actual contact with the stone. Thus, the first current which manifests itself corresponds with the electrodes which are underneath, and the second current only shows itself when the latter are withdrawn, and the upper electrodes have been brought into contact with the stone. It remains to be seen why, in the experiments first described, the current corresponding to the last electrification, and which has the shortest duration, should make its appearance first.

If the phenomenon was only produced with stones of a hard nature, it might perhaps be explained by the simple hypothesis of electrolytic conductivity, and by saying that the gases originally deposited upon the electrodes, being neutralised by those developed after the contrary electrification, these latter, by their immediate reaction upon the gases condensed in the interior of the stone, and playing the part of electrodes, must not only cause a current in their proper direction, but also prevent these condensed gases from producing a current of their own, by giving them an electric polarity the reverse of that which it would be necessary for them to have, in order to react, by decomposition, upon the moist conductor. There would be, as a consequence of this effect, a momentary paralysis of the action of these gases, and their effect could only be produced when the action of the gases of the electrodes had ceased; hence the reversal in the direction of the polarisation current. However, the fact of the reversal taking place in the body of a homogeneous liquid conductor makes this explanation at least incomplete; for it is difficult to admit, in a liquid conductor, a condensation of gas taking place in the body itself of the liquid mass.

But this insufficiency of the electrolytic theory does not stop here; it appears again in the effects which follow the action of the currents, and even in the effects of heat upon hard stones. How, for example, can we explain the successive diminution in intensity of the currents transmitted by the silexes, when the direction of the current is alternately reversed; and then, that these alterations increase it, on the contrary, in moist stones, by reason of the addition to the current which passes through them, of the polarisation current resulting from the reverse electrification which has preceded? How, finally, can we explain the sensible amount of conductivity retained by the silex after it has been for a long time heated in an oven, and is experimented upon whilst still in a burning state? It is certain that there must yet exist some peculiar electric effect, which is independent of electrolytic action; to exactly ascertain its nature many experiments are, however, yet necessary, and I believe that electro-tonic conductivity, as well as the electrostatic polarisation of which mention has been already made, must have more or less to do with the matter; it is, in all probability, to these causes that we must refer the polarities, very weak, it is true, but nevertheless quite appreciable, which are observed in homogeneous and slightly moistened bodies, when the latter are made the media for the passage of electric currents.

In conclusion, stones are more or less conductors, and their conductivity may depend either on the nature of the matter composing them, or, as in the majority of cases, on the moisture which has penetrated them. It is only minerals which have undergone fusion and crystallization which are nearly insulators, although they manifest certain effects of condensation, giving rise to a kind of electro-tonic conductivity, which may be found generally in all stones, but which is obliterated by the other conductivities acting in a much more energetic manner. In consequence of their electric conductivity, stones develop, after the passage of a current, very energetic and rather complicated polarisation effects, which, re-acting upon the currents, modify their intensity in different directions, according to the resistances which are opposed, and which, combining with certain crystalline dispositions of the stones, may produce reverse effects in the same stone, according to the direction of the current which has passed through it. Thus, we find stones in which the current increases in intensity with a certain direction, and diminishes with the opposite one; resinite quartz and sardonyx are stones of this kind.

The conductivity of stones is very much affected by heat; in the majority of cases heat diminishes the conductivity, in a considerable degree, by the drying-up which it causes; in some cases, however, an increase results, and amongst the stones in which this is the case, may be mentioned oligist, magnetic iron, wolfram, stibnite, cinnabar, and, in general, those metallic minerals which have a certain resistance; when minerals, on the contrary, have no resistance, heat reduces their conducting power, as in the case of metals. The calorific effects in stones are almost always accompanied by thermo-electric currents, which are highly developed in metallic minerals, and which, naturally, complicate the effects of conductivity which we have been considering; and as, in consequence of their want of homogeneousness, they present very great differences in conductivity, not only in one specimen as compared with another, but even in the different parts of the same specimen, it is impossible to state in figures the conductivity or the resistance of different kinds of stones. All that can be said is, that amongst the metallic minerals, the sulphurets of iron, of cobalt, of nickel, of copper, and pyrolusite, conduct the best; that the sulphurets of mercury and antimony, cinnabar and stibnite, conduct the worst; and that oligist, magnetic iron, zinc-blende, &c., have a mean resistance which may vary between 2,000 and 250 kilometres of telegraph wire. As for other stones, the silexes conduct the best, although a sample, about 4 centimetres long, of one of the best of them, gives a resisiance of 2,000 kilometres.

It is thus seen that this conductivity of stones is but relative, and that although a sensible deflection may be obtained upon a galvanometer of 36,000 turns, these stones may have an enormous resistance; as, for example, 15 millions of kilometres for a deflection of 12°; cornelians and agates are conductors of this kind when kept in a dry room.—(*L'Electricité.*)

On completion of the laying of the Eastern Telegraph Company's second cable for the Suez-Aden section—which will probably be about the 7th of November—the Hibernia will proceed to Bombay, to shift the portion of the shore end of the present cable, and to lay about five miles of heavy cable for the shore end of the duplicate line between Bombay and Aden. The expedition with the Bombay-Aden main cable is expected to arrive about next March. Captain Halpin is in charge of the present expedition.

ON A NEW FUNDAMENTAL LAW OF ELECTRO-DYNAMICS.

TILL quite recently Weber's law was generally accepted as a fundamental law for all electrical phenomena, embracing the laws of static electricity, and electro-dynamic as well as induction phenomena. It is based (as is known) on the assumption, that two particles of electricity which are in relative motion exert forces on one another, which are different from the forces exerted by the same particles on each other when at rest. The first objections against Weber's law appear to have come from the English side. In Thomson and Tait's Handbook of Theoretical Physics, the Weber hypothesis is cited as an example of a theory which is rather injurious than useful, because Weber's conclusions are in contradiction with the conservation of energy, and because the supposition of two different electric fluids cannot possibly correspond to fact. The English views were adopted and advocated by Helmholtz in a work published in 1870. This work was the beginning of a long controversy with regard to Weber's law, in which various *savants* took part; a controversy which, indeed, still continues.

Recently M. Clausius has sought to replace Weber's law (which he rejects, as contrary to fact, on grounds independent of those of Helmholtz), by another. He starts from representations which differ in essential points from those hitherto common. He supposes that the electro-dynamic action of two moved particles of electricity on each other is by means of matter existing between them. Consequently, it is not necessary that this action depend merely on the relative motion of the particles, but it may also be influenced by their *absolute* motion: since the moved particles behave ever differently with regard to the medium between them, acording to the kind of motion. In this representation, the supposition is no way unnatural, that the direction of the electro-dynamic force does not coincide with the connecting line of the particles. On the basis of this supposition, M. Clausius has given, for the action between two electric particles, general expressions, from which all forces exerted by galvanic currents on each other, and inductive actions, may be deduced. Specially as regards the force which one current-element is subject to from another, M. Clausius obtains an expression for it, which is somewhat more general than Ampère's expression for the same force. Clausius' expression passes into that of Ampère if we give to a certain constant the value 1. In the action of closed currents on one another, which it has only been possible to investigate experimentally hitherto, that constant goes quite out from the result. In this case, therefore, the new law of Clausius agrees perfectly with experience. With regard to that undetermined constant, M. Clausius expresses the conjecture that its value is equal to *nil*, because through this supposition the fundamental equations are brought to their simplest form.

M. Clausius has then further examined the question, whether the new law is in harmony with the principle of conservation of energy. He finds that this is the case if we assume that in each current-element there are equal quantities of positive and negative electricity, and if we take into account not only the action of the electrical quantities of like name, but also those of unlike name. The members connected with the hitherto undetermined constant do not, of course, range under the law of the conservation of energy, but disappear for closed currents. If that constant be equal to *nil*, then even for the elementary action the agreement with the law of conservation of energy is perfect.

In conclusion, M. Clausius gives a further expression for the elementary action between two current particles. It differs from the first, only in the parts by which the action of closed currents is not affected. The further conception (in addition to the one above referred to, and likewise differing from that hitherto common) underlies this expression, that the force which one particle exerts on a second is not similar to the force which the second exerts upon the first.—*Der Naturforscher.*

A TORPEDO COLLEGE IN CHINA.

THE first quarterly examination of the students of the Imperial Torpedo College, Tientsin, China, was held (says a correspondent in that country) on the 21st July, under the direction of His Excellency Li Hung Chang. The College was removed from Foochow to head-quarters at Tientsin, in April last. There are at present thirty-six students, which number it is intended to bring up to forty. Several of the students have received a thorough English education at the Government Schools at Hong Kong, while others have passed a three years' course at the Naval Schools at Foochow Arsenal. His Excellency Li Hung Chang arrived at the College at 8 a.m., and the examination at once commenced. The subjects for examination were—Proficiency in the English Language, Translation of English into Chinese and *vice versâ*, Telegraphy and Electrical Testing, &c. In the afternoon a large number of torpedoes were placed in position by the students, and the use of the "firing arcs" shown by the Director, Mr. J. A. Betts, M.S.T.E.; rafts representing boats were destroyed as they passed over the various lines of torpedoes, the officials seeming much impressed with the precision with which each particular torpedo was fired. Some experiments were made with gun-cotton manufactured at the College.

At the conclusion of the examination His Excellency awarded prizes to the whole of the students of the first class, and expressed his pleasure to Mr. Betts at the progress made in so short a time.

Stores are now on their way out from England, for the purpose of erecting a line of telegraphs from the College to the Viceroy's yamen; the line is to be put up entirely by the students, and will be about five miles in length. Once this line is up, we may hope to see telegraphs introduced by the Chinese Government, the great objection to their use having hitherto been that foreign engineers had to be employed, both for their construction and maintenance.

Notes.

AN instance of the somewhat rare phenomenon of lightning in a clear sky has been described to a scientific society in Dresden, by Dr. Roch, of Senftenberg. In the early days of July there had been a good deal of thunder and lightning. On the afternoon of the 4th the sky overhead was quite clear, and only a few heavy thunderclouds rested on the horizon in the W., S.W., and N.E. About four o'clock Dr. Roch, with some friends, was walking in the garden, enjoying the fresh air. They were able to count 13-15 seconds between each flash and peal from the distance. Suddenly, just above them, a brilliant, loud-crackling flash passed through the heavens, from N.W. to S.E., throwing the company into some alarm. It was a justification of the poet's line: "Auch aus entwölkter Höhe kann der zündende Donner schlagen." It is notable, further, that, after this flash, there was no more of the distant lightning and thunder. The heavy clouds soon retired, and the sky was once more clear throughout.

We are glad to observe that the lightning-conductors of our countrymen, Messrs. Sanderson and Proctor, have gained a medal at the Brussels Exhibition, and that M. Michel, Secretary of the French Committee for lightning-conductors, has commended the system "*comme le plus parfait que je connaisse.*"

A correspondent of the *Eastern Province Herald* (Algoa Bay) suggests a plan by which the South African Colonies may be brought telegraphically a week nearer to England than at present. What is wanted for the moment to fill the hiatus due to the failure of Hooper's contract, is merely a loop-line of cable between St. Vincent and Goree or or Dakar, close to Cape Verd. A light line with heavy ends, about 600 miles total length, would span the space to the main land, at the parts indicated, which all mail-vessels closely pass, and could manage to "call off" with very little delay for telegraphic dispatches generally. The Cable Company would probably execute the job straight-way after preliminaries, and doubtless the French and British Governments and the Colonies would be willing to contribute to meet the trifling expense of this enterprise, which would bring South Africa within twelve days of Europe, and be of immense value, should energetic action be required in the Transvaal imbroglio.

In a letter to *Nature* (October 19), Messrs. Ayrton and Perry, of the Imperial College of Engineering in Tokie, Japan, describe experiments made to ascertain the resistance of the electric arc, in order to determine theoretically the best arrangement of cells for the production of the electric light. The results show that with the common Grove cells, no attempt should be made to join any of the cells in parallel circuit until at least 200 have been joined in series; for since the resistance of each cell is about 0·2 ohms, 200 of them would have a resistance of 40 ohms, which is certainly less than *double* the electric arc for that battery corresponding with brightest light, and the authors have shown (in our Journal, March 15th, 1873) that the cells of a battery should be joined in series till the battery of resistance is *double* the external resistance, at which point the battery should be joined in two rows each containing half the whole number of cells in series, and the two rows connected in parallel circuit.

The shock-wave generated by the recent Hell Gate explosion was carefully observed by General Abbott and his assistants, stationed at distant points, with which telegraphic communication was held. At West Point, fifty miles away, no shock was perceptible even with the delicate instruments employed. At Springfield Junction, Long Island, at a distance of twelve miles, the shock was noted in 13 seconds after the time of explosion. General Abbott is preparing a paper giving all the results of his observations, which will be read at the next session of the American Academy of Sciences.

The award made for the Brooks improved insulator, at the Centennial Exhibition, is the only medal awarded for telegraph insulators of any description. The juror in this case was Sir William Thomson. This is the third award (says the *Telegrapher*) the Brooks insulator has received at International Exhibitions, and in every instance, when not the only one, it has been the highest.

"The Thorsdale Telegraphs" is the title of an amusing and clever story in *The Atlantic Monthly* for October. Its scene is one of the lonely telegraph stations on a railway in the Western States, where, however, the life is not entirely unenlivened; at least, if telegrams are received like the following, which a newly-come young lady-operator is asked by the stolid head-clerk, Mr. Thor, the only other occupant of the office, to take down: "Kettridge crazy drunk; is armed and desperate. There will be a smash. Have telegraphed all along the line to people at stations to jump the train and choke the villain. If he reaches Thor, he may stop. If so, take him yourself. O'Bryne, his fireman, just in with ankle sprained; Kettridge heaved him off the tender. Conductor new hand, and a skunk. Watch out. Get depot hands to help you. Shoot him on sight, if necessary. If he gets by Thor, he will smash into the up express, which, though instructed to go back, is too far this way to be saved on a single track. Watkins." Mr. Thor does his duty like a man. Miss Brown unexpectedly shares the fame of his heroism, and a large amount of *fêting* ensues. For the ultimate happy issue of these events we must refer to the journal itself.

In the electro-pneumatic system of house-bells, air is compressed by means of a press button through a metallic tube, and thus made to produce contact and to ring an electric bell actuated by a single pair of elements, contained in the bell case itself. An indicator falls at the same time. The arrangement is simple and convenient, and it offers certain advantages as regards cost, strength of battery required, easy fixation by any workman, small liability to derangement, &c.

The Journal of the Society of Telegraph Engineers (No. 12, vol. iv.) commences with an opening address by the President on the late Sir Charles Wheatstone, and contains valuable papers (read before the Society) "On the respective Merits and Durability of Gutta-percha and India-rubber Joints," by H. C. Mance; "On Experiments to ascertain whether the Toredo-Borer prefers Gutta-percha to India-rubber," by the same author; "On Cable-Borers," by G. E. Preece; "On Underground Telegraphs," by Chas. Fleetwood. Among various interesting matter in the "Original Communications," is an account of D'Arlincourt's relays, and another of experiments, by Lieut.-Colonel Stotherd, as to the effect of firing a mine by electricity on conducting cables and fuzes in its vicinity.

The Annual Report of the President of the Western Union Telegraph Company is published in the *Telegrapher* of Oct. 14. Since the present Company was completed, ten years ago, by the consolidation of the leading telegraph companies in the United States, the mileage of line has been increased 96 per cent., the mileage of wire 142 per cent., the number of offices 214 per cent., the number of messages annually transmitted 219 per cent., and the tolls reduced 52 per cent. The capital stock outstanding has been reduced from 41 to 33 million dols., the difference (in the treasury), with other property acquired, representing an aggregate value of nearly 12 million dollars. The average cost of transmitting telegrams in Europe is 5-8ths of a cent more than the average cost of transmission by this Company.

A bronze statue to Oersted, the discoverer of electro-magnetism (who died twenty-five years ago), was unveiled at Copenhagen on the 25th of September.

A poor fellow, seeking for employment in a Chicago telegraph-office, finally asked to be hired as a telegraph-pole. It was no use, every post was full.—*Telegrapher*.

The Western and Brazilian Telegraph Company received intimation, on the 20th ult., of an interruption on the Bahia Rio de Janeiro section of their cable.

The Report of the West India and Panama Telegraph Company, for the first six months of 1876, states that the amount to credit of revenue is £37,942, and the expenses have been £20,485. The Directors propose to pay 10s. per share (£12,500) on account of arrears of dividend on the first Preference Shares, carrying forward a balance of £6,852. The traffic receipts show an increase of 7 per cent. over those of the half-year ending 30th June, 1875. The Para-Pernambuco cable is still interrupted. A memorial, setting forth the wrongs which the shareholders have endured, is addressed by the Board to the Governors of the various islands having Tariff clauses in their acts.

The Eastern Telegraph Company (Limited) announces that the Eastern Extension Company's Madras-Penang Cable has been repaired, thus restoring telegraphic communication with the Straits Settlements, Cochin China, China, Japan, Java, Australia, Tasmania, and New Zealand. Telegrams should be directed "*viâ* Eastern." The same company also notifies that the Eastern Extension Company's Singapore-Batavia Cable is interrupted, but as there is a frequent steamboat service between the two places, the delay on messages to Java and Australia until the cable is repaired will not be serious.

NOTES OF TRAFFIC RECEIPTS.

West Coast of America Telegraph Company, for four weeks ending 29th July, £2,899.

Western Brazilian Telegraph Company, for September, £9,559, against £9,297 in the corresponding period of last year.

West India and Panama Telegraph Company, for August, £3,810, against £2,992 in corresponding month of 1875.

Direct United States Cable Company, for week ending 14th October, £3,600; 21st October, £3,700.

Anglo-American Telegraph Company, 18th October, £1,730; 19th, £1,730; 20th, £1,620; 21st, £1,530; 22nd, £520; 23rd, £1,380; 24th, £1,660.

Electrical Science in Foreign Journals.

COMPTES RENDUS OF PARIS ACADEMY.

NO. 12: 18TH SEPTEMBER, 1876.

On the Physical Properties of Gallium. By M. LECOQ DE BOISBAUDRAN.

NO. 13: 25TH SEPTEMBER.

No papers on electrical subjects.

NO. 14: 2ND OCTOBER.

Influence of Temperature on Magnetisation. By M. GAUGAIN.

WHEN a bar of steel with one end in contact with a magnet is several times alternately heated and cooled between temperatures T and *t*, the corresponding magnetisms M and *m* at length assume variable values. The difference M — *m* denotes the *temporary variation*, and the proportion $\frac{M-m}{M}$ its relative value. M. Gaugain shows that this co-efficient increases sensibly as you pass away from the point of contact. Again, calling M_0 the magnetism obtained at ordinary temperature at a certain point of the bar, before any heating, and M that obtained at the same point after a series of heatings, the difference $M - M_0$ represents what the author calls the *permanent variation*, and the proportion $\frac{M - M_0}{M_0}$ its relative value. This also increases as you move from the point of contact between bar and magnet, and much more rapidly than the co-efficient of *temporary variation*. With very long bars one may always find a point where the magnetisation M_0 is sensibly *nil*, though M has a very appreciable value. The co-efficient of temporary variation is independent, at least within certain limits, of the intensity of the magnetising force; that of permanent variation increases as this force diminishes.

NO. 15: 9TH OCTOBER.

On the Absorption of Free Nitrogen by the Immediate Principles of Plants, under Influence of Atmospheric Electricity. By M. BERTHELOT.

THIS is in continuation of researches described in our last issue (page 271). Formerly he employed high tensions; here the normal weak electric tension of the atmosphere. One closed tube of thin glass was enclosed in another tube also closed or communicating with the air. In the inner tube was a roll of silver or platinum, communicating by wire with a conductor electrified by the atmosphere two metres above the ground. (Thomson's apparatus with water-flow was employed.) A thin sheet of tin was rolled round the outer tube, and connected with conducting ground. Into the space between the tubes was introduced pure nitrogen, or ordinary air, along with strips of moist white filtering paper or two or three drops of a syrupy solution of dextrine. Twelve tube systems, variously arranged as indicated, had the platinum wires of their inner armatures connected together, and those of their outer armatures together and with the ground. The experiments extended from 29th July to 5th October this year; the mean electric tension having been about that of 3⅓ Daniell elements, but having oscillated between + 60 D and — 180 D. In all the tubes nitrogen was fixed by the organic matter (paper or dextrine); and to the extent of one to several milligrammes per tube. The conditions are analogous to those of vegetation, magnified in the ratio between the distance of the tube of Thomson's apparatus from the ground and the interval between the two armatures of the tubes. On the moist paper in some of the nitrogen tubes were found greenish spots formed by microscopic algœ; doubtless the germs were introduced accidentally before closure. In these there was considerably greater fixation of nitrogen than in tubes without the plants. These observations point to the working of a natural cause, hardly suspected hitherto in vegetation, yet of very considerable force.

BULLETIN DE LA SOCIÉTÉ D'ENCOURAGEMENT POUR L'INDUSTRIE NATIONALE.

SEPTEMBER, 1876.

Report by M. Le Blanc (in name of a Committee), *on Delachanal and Mermet's New Spectro-Electric Tube or Fulgurator.*

THIS apparatus, which is meant to afford continuous instead of intermittent vision of the spectral lines from any substance, is strongly recommended to chemists. It consists (as may be known) of a glass tube like a test tube, with stopper, through which passes a thin glass tube enclosing a platinum wire. The wire reaches to nearly the bottom of the vessel, projecting somewhat beyond the enclosing tube. A short hollow conical glass tube, with enclosed platinum wire, forming the other electrode, rises from the bottom. A little of the solution to be examined is put in the bottom; it rises in the cone by capillary force, so that it covers the point of the lower (negative) electrode. Sparks from an induction coil are passed between the wires. The spectral lines can be examined a long time continuously. By an arrangement of M. Duboscq the tube can be instantly replaced before the slit by another containing a known solution, &c. An observer having a set of the tubes thus arranged, containing each a different metallic solution, may, in a short time, show distinctly the various systems of rays characterising each metal, and make spectroscopic observations very easy to his students.

ANNALES TÉLÉGRAPHIQUES.

JULY—AUGUST, 1876.

On some Modifications in the Electric Communications of the Meyer Multiplex Apparatus. By M. MOREL.

THESE consist in (1) the employment of two distinct relays for reception at the receiving station and control at the sending one; (2) in a new arrangement which M. Meyer gives his key so that the two stations can work with the same pole of the battery. M. Morel also indicates a means of remedying the inequality of duration of the emissions meant for formation of the dot and the dash.

Application of Reversed Currents to the Multiplex Apparatus. By M. WILLOT.

AFTER each emission of current, in the present system, there is an interval of earth connection to discharge the line. The interval is far from sufficient to bring the line to neutrality each time, and this incomplete discharge is against the success of the multiplex apparatus on long lines. M. Willot's object is to remedy this by a system of reversed currents, like that adopted by M. Siemens for submarine lines.

The Loop-Test. By J. R.

Electro-magnetic Registers. By M. DEPREZ. (From *Journal de Physique.*)

Electric Telegraphy without a Conductor, and Electro-Diapasons. By M. BONTEMPS.

THE author gives a *resumé* of the observations of Bourbouze, De Parville, Lacour, Mercadier, and others, and gives figures indicating a solution of the problem.

On the different Systems of Electric Clocks, and on the Method of Regulation of Clocks by Electricity, devised by Froment. By M. D. FROMENT.

On an Apparatus of M. Melsens called the Rhe-electrometer. By M. HERVÉ MANGON. (See note on page 273.)

Wheatstone's Electric Jacquard. By M. BONTEMPS.

ELECTRICAL SCIENCE IN ST. PETERSBURG.

IT is our endeavour to convey in these columns some idea of what is being done in electrical science in the various great centres of scientific thought. The progress of general scientific researches in Russia, which, through the improvement of education and other causes, has been much accelerated in recent years, is perhaps apt to attract too little attention in this country, partly, no doubt, on account of the strange tongue in which the researches are often published, and partly because of the distance of that great continent. A recent number of the *Journal de Physique* furnishes an account of recent proceedings of the Physical Society of St. Petersburg, and as electricity and magnetism bulk pretty largely among the subjects treated, we invite the attention of readers for a brief space to these researches.

Some phenomena produced by electricity on pulverulent substances have been studied by M. Evald, who has sought to reduce the Lichtenberg figures to their simplest form. An uninsulated metallic plate covered thickly with lycopodium powder is brought under a metallic point. The point is electrified positively with a rubbed glass tube; the plate is turned and a slight shake is given to it. The powder uninfluenced by electricity falls, and there is formed on the plate a small shield of adherent powder, like a drop of liquid, the centre coinciding with the end of a perpendicular from the point to the plate. A negative charge gives a similar figure, but surrounded by a ring. Increasing the distance between plate and point, the positive figure does not change, but the ring of the negative diminishes and disappears. On the other hand, diminishing the distance, the positive figure is reduced to a ring with a small mass of powder in the centre, and the negative figure to a simple ring. If screens are interposed between point and plate, their exterior contour plays the principal *rôle*, determining the form of the figure. M. Evald is inclined to think (contrary to Faraday's opinion) that the powders, submitted to repeated shocks, form masses similar to drops of liquid under the direct influence of molecular attraction between the particles rendered free in space for an instant by the action of inertia and under influence of vortices of air. In one experiment (favouring this view) he placed under a pneumatic receiver a galvanic bell, the hammer of which struck a membrane stretched horizontally and covered with lycopodium. The masses of drop-form are produced on the most agitated parts of the membrane, even when the pressure is reduced to 25 millimetres of mercury. The negative result of a similar experiment by Faraday is attributed by M. Evald to the too small intensity of the vibrations he produced.

Assuming that the force of an electro-magnet increases with the product of the force of the current and the number of turns of the bobbin, and the surface of the battery and dimensions of the bobbin being given, M. Kraiewitsch proves that this force is independent of the thickness of the wire, if the condition of equality between the resistances of the battery and the wire be fulfilled.

In another paper, M. Bobyleff demonstrates that the distribution of electricity on the surfaces of any conductors placed in a dielectric medium is similar to that which would occur in vacuum, if the tensions on the conductors were the same. The density is greater in the ratio $(1 + 4\pi k) : 1$ or $1 + 4\pi k$; k is the dielectric constant of the insulating medium. M. Bobyleff also shows theoretically that the reciprocal action of two conductors placed in a dielectric fluid is diminished in the proportion of the square of the dielectric constant k, if the quantity of electricity remains the same as in vacuum.

A particular case of distribution of the galvanic current in a thin plate is analysed by M. Schwedoff experimentally and theoretically. Some small discordances between theory and experiment conduct the author to the idea of the existence of diffraction of electric rays.

The influence of temperature on galvanic elements is studied by M. Stepanoff, and with the following results:—The electromotive forces of the Daniell element at temperatures of 20, 40, 60, and 80 degrees are nearly equal, and in four hours of action decrease about 5 per cent. The electromotive forces of the other elements examined (Bunsen-Poggendorff, Bunsen, and Voisin) depend little on temperature, but decrease more rapidly with the time. In the Daniell element, the intensity of the current at commencement of the action increases very rapidly at the temperature of 40 degrees, and less rapidly at other temperatures, and attains its maximum after five to sixty minutes, thereafter decreasing slowly. The intensity of current from the Poggendorff element, during the first quarter of an hour, remains nearly constant at temperatures of 20° to 40°, increases rapidly at 60° and a little less at 80°; after that it decreases very rapidly at all temperatures. The variations of the Voisin element are similar to those of the Poggendorff, but on a much smaller scale. With increase of the temperature, the variability of the intensity is more pronounced.

It is known that a single Daniell element cannot produce the decomposition of water, but if there be introduced into the circuit of such an element a voltameter and a galvanometer, a deflection of the needle will be observed at the moment of closure or rupture of the circuit. These phenomena have led some to compare the voltameter to a condenser of large capacity. It is a question whether the conducting liquid can exercise the electro-dynamic action while the electrodes are charged. MM. Schiller and Colley have made the following experiment:—In a Wiedemann galvanometer one of the ordinary bobbins was replaced by a spiral formed of a caoutchouc tube, filled with water, deprived of air and a little acidulated. The spiral consisted of thirteen turns, six centimetres in diameter. Its resistance was 1,600 Siemens units. The two bobbins, metallic and liquid, were placed so that the current of four Daniell elements, traversing both bobbins at once, and decomposing the water, did not deflect the magnet. Then the four Daniell elements were replaced by *one;* and during closure of the circuit no deflection was observed. But if the metallic bobbin be removed, a deflection is observed; its first extent was about twenty divisions.

In a memoir on the mechanism of magnetic phenomena, M. Chwolson first seeks to show that Weber's hypothesis, properly applied, explains the increasing course of the magnetising function. Then he applies this hypothesis to explaining the phenomena of permanent magnetism, adding to it the supposition that each molecule is submitted to the influence of a constant resistance, similar to friction. He explains by surface action all the phenomena of permanent magnetism. M. Chwolson's experiments confirm one of M. Jamin's laws—viz., "The temporary magnetism developed by a current is independent of the permanent state;" but M. Jamin's other law: "The magnetism destroyed by an inverse current is also independent of interior magnetisation," is considered inexact.

The electromotive force of a battery is proportional to the total quantity of energy developed by the reactions producing it. This force decreases if the current does mechanical work; it increases, on the other hand, if an exterior mechanical force produces the movement which the current tends to produce. Setting out from these known facts, M. Colley finds that during electrolysis of a vertical column of liquid, the transport of matter from below upwards diminishes the existing electromotive force, and *vice versâ.* The most conclusive of his experiments is as follows:—A concentrated solution of nitrate of silver was put in a vertical glass tube 1·6m. in length, and containing electrodes of silver at its two extremities; the liquid was somewhat freed of air by means of a pneumatic machine, after which the tube was closed. A very sensitive astatic reflecting galvanometer, introduced into the circuit, showed a weak current due to inequality of the electrodes. The deflection caused by this current, when silver was deposited on the upper electrode, was increased, on an average, about 43 millimetres, when the tube was turned 180° about a horizontal axis. The experiments of Helmholtz on polarisation in liquids containing traces of air in solution have demonstrated that there is produced, under these conditions, a transport of gases from one electrode to another. Consequently, the numerical result of the experiments described is nearly twice smaller than that given by calculation based on the hypothesis that there is merely electrolysis of the salt of silver.

Review.

Electro-Telegraphy. By Frederick S. Beechey, Telegraph Engineer. London: E. and F. N. Spon, 48, Charing Cross.

This little work goes over well-trodden ground, but does so in a manner which, so far, at least, as practical telegraphy is concerned, deserves approval. After two chapters on the nature and sources of electricity, the action of the galvanic battery is dealt with, and several kinds of battery are described. The principles of land-telegraphy are then explained, and this portion terminates with a brief account of the Postal Telegraph Office in London. Submarine telegraphy next occupies two chapters; and the subjects of the duplex, measurement of currents and testing, and lightning protectors, claim one each. The limits of the book do not permit of very full treatment of the subject; but it appears to us a good example of *multum in parvo.* We have noticed indeed, in one or two places, a tendency to unnecessary reiteration, as on page 12, in speaking of the resistance of a wire in relation to its thickness; but the descriptions are generally succinct and good. On page 116, the metre is erroneously stated to be "a certain sub-multiple of the diameter of the earth," and the explanation of the Ohm on the same page is somewhat faulty. The figures, though a little crude, are mostly sufficient to explain the author's meaning, and they are not complicated with unnecessary details. We can recommend the book to those desiring an elementary acquaintance with the principles of what we are hardly disposed to designate, with the author, "Electro-Telegraphy."

Correspondence.

THE AUTOKINETIC TELEGRAPH.

Adverting to the letter in your Journal of the 1st instant, signed "W. H. Davies, Managing Director of the Exchange Telegraph Company," in which he refers to your previous notice of the Autokinetic Telegraph System, and wherein he seeks to urge the complete efficiency of the American system, which he is endeavouring to introduce here, I must beg you will kindly favour me with space, in your valuable columns, to refute some of his statements, and to point out also wherein lies the great superiority of the extremely ingenious Autokinetic Telegraph for all practical purposes.

I am surprised that Mr. Davies should have had the temerity to say, in referring to interruptions caused by two or more signals being confused, from being sent simultaneously, in the ordinary single wire system, that "*no inconvenience whatever is experienced in practice from this cause*," for every telegraphist is so fully aware that interruption of business, delays, and grave inconvenience are continually occurring from this cause; and we need only refer to a late inquest into the case of a recent terrible railway accident, to find that the death of many unfortunate persons, and injury to many more, were almost wholly attributable to to this; and there is every reason to feel confident that the accident referred to, and many similar ones, with their lamentable results, would never have happened had the Autokinetic system been in use on the railway circuits, which would have prevented the possibility of interruption on the line, and what is technically known as "*fighting for circuit*."

Mr. Davies repeats in his letter a simile made use of by the President of the American Company, to the effect that "The danger of signals interfering with each other on the single line system is about equal to the danger of an individual being struck with lightning." As all telegraphists are so thoroughly conversant how often such interferences do occur on a single line, I can only say that the danger of being struck with lightning must be uncomfortably constant on the other side of the Atlantic, or what is more probable, your correspondent's American friend, in his anxiety to bolster up an inefficient system, has been led to make a statement certainly not in accordance with experience.

I freely admit that the system introduced by Mr. Davies is very simple and compact, and may in the absence of a better be made to answer on short circuits, with comparatively but few houses in connection, for which it is alone adapted and used, for with its single line, and the current passing, as it does, through each instrument in circuit, it would be utterly impossible to extend the circuit to embrace an entire city like London.

To overcome the resistance of the instruments alone would in such a case require a battery so powerful and large, that in addition to the extravagant cost it would require a very great space to contain it; while the chance of any message reaching its destination without interruption would be remote indeed. But with "The Autokinetic system"—with its inexpensive second wire and very moderate battery—with its simple and effective little instrument and ingenious connecting up the wires—however large the circuit—however numerous the telegrams—we have always one wire free and uninterrupted for the passage of the signals (impossible to be interfered with by others, however numerous may have been the messages placed in other instruments almost simultaneously) in readiness for transmission, and which would follow in quick and uninterrupted rotation without the possibility of break or confusion of signals, rendering it possible, were it desirable, to connect up every house in a city like London, or twenty such cities, in one vast circuit. Not only this, but also by an ingenious arrangement in the sending apparatus the messages can be sent at will, to one or other receiving station *only*, as, for instance, notices of fire could be sent to the fire-station only, notices of robbery, &c., to the police-station only, &c., and equally at will by a simple contrivance the messages could at the same moment, if desired, be sent to all.

The Autokinetic Telegraph, unlike other systems intended for similar purposes, is not limited to the transmission of only three or four signals, but by the adaptation of the principle in a somewhat different apparatus to that intended to be employed for fire and police alarms, though not more complicated in character, the number of different messages capable of being sent entirely automatically is practically unlimited.

Some of the improved instruments with important modifications (suggested by the talented inventor) are now being made, and will shortly be ready to be viewed at work, when I will beg, Mr. Editor, the favour of your inspecting for yourself the advantages claimed for the "Autokinetic Telegraph System." A. M. MOIR.

One of the Concessionaires
of the "Autokinetic
Telegraph."

London, *9th October*, 1876.

J. M.—Your lines are hardly suitable for our columns.

PATENTS.

3997. J. BETTELEY.—"Improvements in ships and boats, and in appliances relating thereto."—17th November.

3999. A. BROWNE.—"Improvements in electro-magnetic engines, and galvanic battery to be used therewith, the said battery being also applicable for other purposes."—18th November. (A communication.)

4115. W. T. HENLEY.—"Improvements in the construction of submarine telegraph cables, and in the mode of insulating the conductors used therewith, applicable to other telegraphic purposes."—26th November.

4118. E. L. PAINE and L. NELSON.—"Improvements in electro-magnetic motion."—26th November. (A communication.)

4122. J. BANNEHR.—"Improvements in means for intercepting and treating excreta and other matters of sewage."—27th November.

4148. A. M. CLARK.—"An improved automatic signal-buoy."—30th November. (A communication.)

4200. D. BULL.—"Improvements in generating and applying heat in evaporating saline and other liquids in the manufacture of chloride of sodium and other crystalline substances, and for other heating purposes, and in apparatus connected therewith."—4th December.

4206. W. R. LAKE.—"Improved electric apparatus for producing fire and light, and designed to be carried in the pocket."—4th December. (A communication.)

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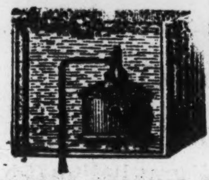

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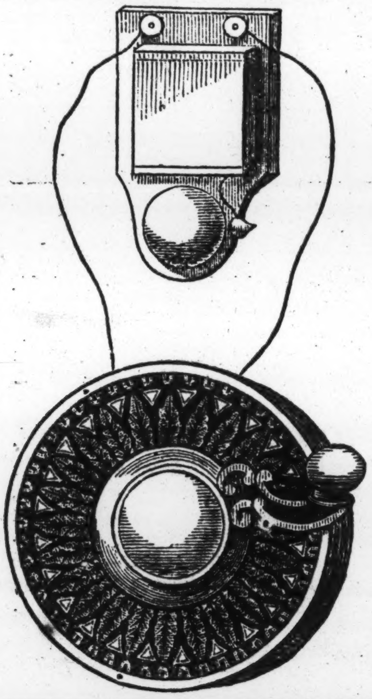

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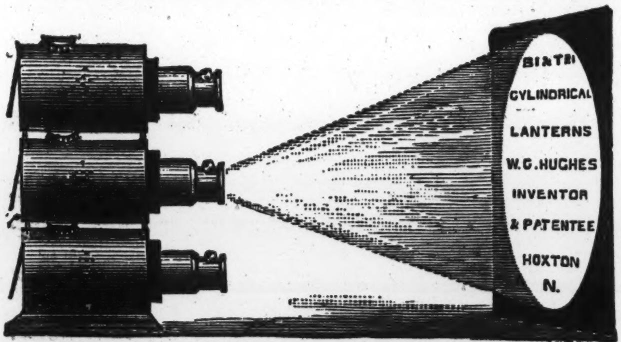

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